

## 5—*A Survey of Vegetable Matter in the Wool Clip of S.E. Australia*

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### Introduction

Leaves, twigs, fruits and other fragments of vegetable matter are picked up in varying quantities by the fleece during the activities of sheep on pasture. The presence of this vegetable matter may interfere with the normal processing of the wool. Moreover, its presence in the finished material is highly undesirable, and every effort has to be made to remove it during processing. Its removal frequently requires special treatment of the wool, involves extra handling, and may damage the wool in some degree.

The presence of vegetable matter in wool, then, constitutes a problem to the processor of wool. It also constitutes a problem to the wool appraiser, who must decide the quantity of vegetable matter present, and its influence on the costs of processing and the value of the finished product. For any detailed study of these problems, information on the nature of the vegetable matter to be found in wool is an obvious requisite.

A survey of vegetable matter found in the New South Wales wool clip was published by Milthorpe (4). A similar survey has now been completed for wools originating from Victoria, South Australia, Tasmania, and those districts in New South Wales adjacent to the River Murray.

### General Procedure

Samples were drawn more or less at random from wools delivered to Victorian, Tasmanian, and South Australian Appraisal Centres. Work was very largely confined to samples which showed an appreciable vegetable matter content—of the order of 1 per cent. or more of the greasy weight. For the most part, the wool was scoured prior to examination. The vegetable matter was removed by hand and identified as far as possible. In each case the identification of type specimens was checked by authorities at the Botany School, University of Melbourne, or the National Herbarium, Melbourne. These type specimens were retained, and other specimens were identified by comparison with them.

The nomenclature and classification of Black (1) have been followed as far as possible. For species not described by Black, the description of Ewart (3) has been used. The common names presented are those listed by C.S.I.R. (2).

The nearest town to the property from which the wool was derived has been taken as being the place of origin of the wool. On the basis of average annual rainfall, the area covered by the survey has been divided into four zones, as set out in fig. 1. The samples have been allocated to the individual zones according to the places of their origin.

No attempt was made to assess quantitatively the amounts of the different types of vegetable matter present in the samples.

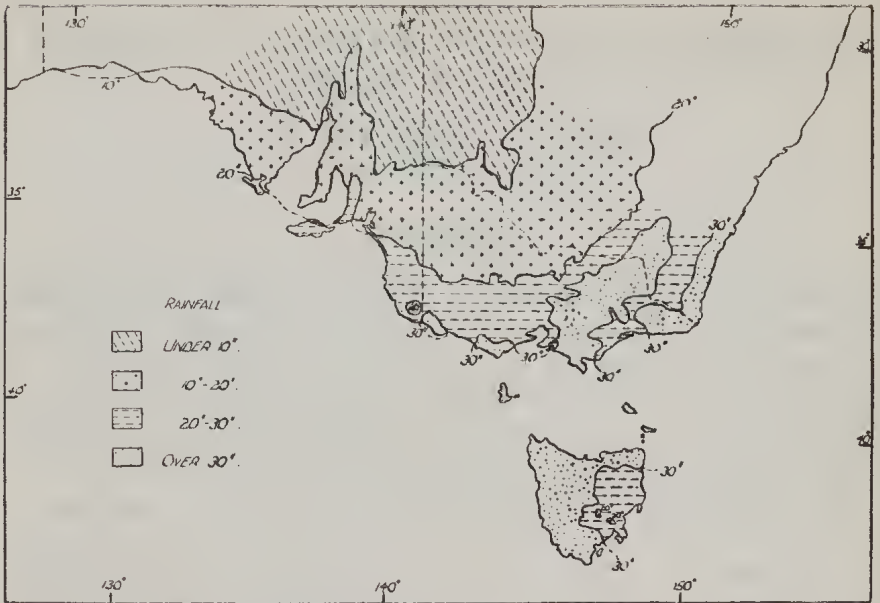


Fig. 1—Map showing area covered by Survey. Isohyets from map published by Meteorological Branch, Commonwealth of Australia, showing average annual rainfall based on figures up to 1938.

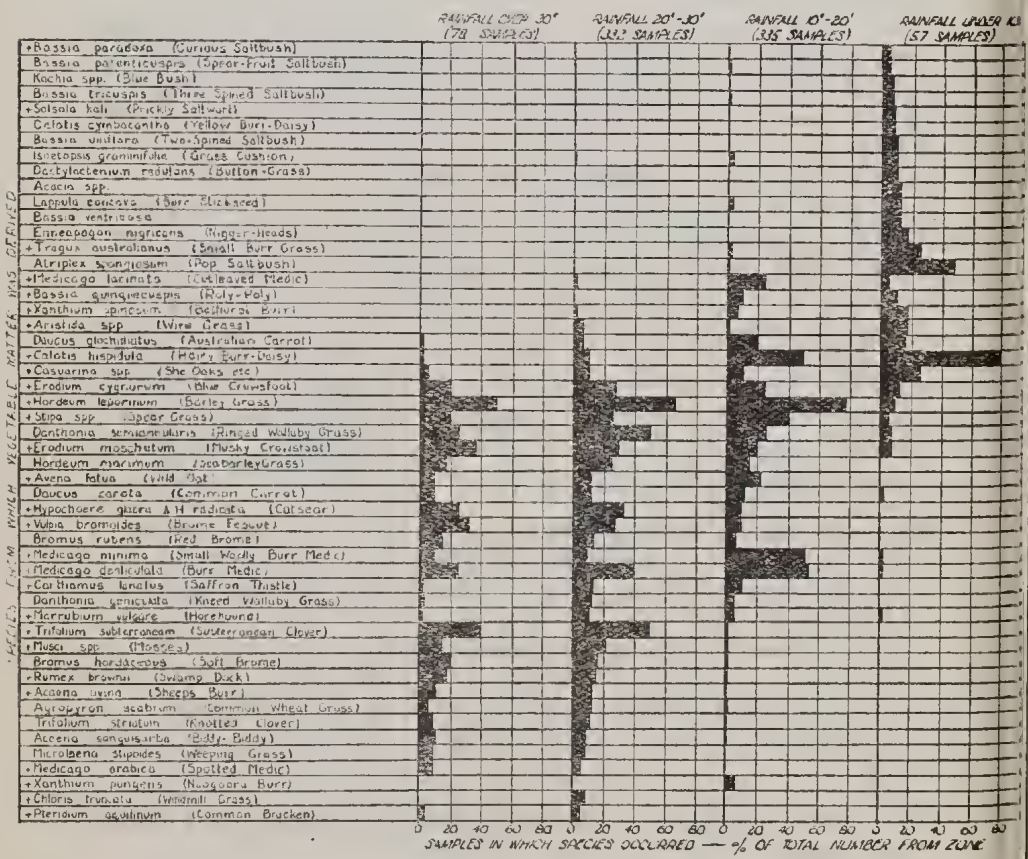


Fig. 2—Relation of type of vegetable matter found in samples to average annual rainfall. Only those species included from which vegetable matter occurred in 5 per cent. or more of the samples from one or more zones.

## Results

Over 800 samples were examined in all. Vegetable matter from 123 species of plants was identified. Mention is made here only of those species from which vegetable matter occurred in 5 per cent. or more of the samples from one or more of the zones. There were 51 of these species which are listed in fig. 2. Twenty-seven of them are recorded by Milthorpe (4). Vegetable matter of the remaining 24 has not previously been recorded as occurring in wool.

### DISTRIBUTION OF SPECIES.

The distribution of the various types of vegetable matter in relation to the average annual rainfall is included in fig. 2, which sets out the proportions of the samples from each zone in which the different types of vegetable matter occurred. As might be expected, there is a distinct relationship between the average annual rainfall of the area from which the wool originated, and the type of vegetable matter found in it.

Nine species, all drought resisting types, were found only in samples from the driest districts, and 12 species, all typical of higher rainfall areas which were found in samples from the two wettest zones were almost entirely absent in samples from the dry districts. Hairy Burr-Daisy (*Calotis hispidula*) and Pop Saltbush (*Atriplex spongiosum*) were the most common types found in these dry areas, occurring respectively in 79 per cent. and 47 per cent. of samples. Grasses and Legumes were not common among the other species, Composites and Chenopods occurring most frequently.

The vegetable matter in the samples from the two wettest zones was of closely similar character, 30 of the 34 species found in samples from these zones being common to each. Most of these species, such as Bidly-Bidly (*Acaena Sanguisorba*), Mosses (*Musci spp.*), Swamp Dock (*Rumex Brownii*), etc., are typical of the vegetation of areas of higher rainfall. Fragments of Grasses and Subterranean Clover (*Trifolium subterraneum*) occurred in a very high proportion of the samples. Wild Carrot (*Daucus Carota*), and the two common species of Crowsfoot (*Erodium spp.*) were three other types found almost as frequently. The Medics (*Medicago spp.*) were recovered from a smaller proportion of samples.

In the samples from the zone with the average annual rainfall of 10 to 20 inches, the greatest variety of types of vegetable matter was recovered, species common to both the driest and the two wettest zones being found. As in the two wettest zones, the outstanding characteristics of this zone was the high proportion of samples in which fragments of the Grasses occurred, the most important being common Barley Grass (*Hordeum leporinum*). Three species of Medic were also recovered very frequently. They occurred in a much higher proportion of the samples from this zone than from any other. Drought resisting types occurred in a smaller proportion of samples than in the driest zone, though Hairy Burr-Daisy (*Calotis hispidula*) appeared in as many as 50 per cent. of those examined. Australian Carrot (*Daucus glochidiatus*) and the two species of Crowsfoot occurred more commonly than in the driest zone, but less commonly than in the two wettest zones,



## NATURE OF VEGETABLE MATTER RECOVERED.

The vegetable matter found with the 27 species recorded by Milthorpe (4) was similar to that described by her. The nature of the material found with the other 24 species is indicated in the following notes and figs. 3-26. Details of the features used in identifying the material are included.

## GRAMINEAE\*

*Danthonia semiannularis* (Labill.) R. Br., Ringed Wallaby Grass, fig. 3. Material recovered: Spikelets, flowers. Identifying features: Spikelet of two outer glumes and 6-9 flowers; flowering glume about 3 mm. long bearing three conspicuous rings of hairs and three awns, the central awn brown and twisted and longer than the lateral ones; palea notched at apex.

*D. geniculata*, J. M. Black, Kneec Wallaby Grass, fig. 4. Material recovered: Spikelets, flowers. Identifying features: Spikelets of four to five flowers; palea blunt and hairy on back; otherwise as *D. semiannularis*, except that awns shorter and central awn not longer than lateral ones.

*Hordeum maritimum*, Huds., Sea Barley Grass, fig. 5. Material recovered: Inflorescence, groups of spikelets, spikelets. Identifying features: Fragments of inflorescence with three one-flowered spikelets at each node; central spikelet fertile, 6-7 mm. long and almost sessile; lateral spikelets sterile, 5 mm. long and stalked; outer glumes in each case awnlike in shape, arranged in pairs and not ciliate; flowering glumes inrolled at the base with long, rough awns.

*Microlaena stipoides* (Labill.), R. Br., Weeping grass, fig. 6. Material recovered: Spikelets, flowers. Identifying features: Spikelets one-flowered, about 30 mm. long; first pair of outer glumes minute, second pair hard and rough, each tapering into a long awn and bearing a tuft of hairs at the base; flowering glume short and inconspicuous.

*Agropyrum scabrum* (Labill.), Beauv., Common Wheat Grass, fig. 7. Material recovered: Spikelets, flowers. Identifying features: Spikelets wedge-shaped, 5-7 cm. long, including awns with six to twelve flowers; flowering glumes narrow, rigid, rough, with awns about 3 cm. long.

*Bromus rubens*, L., Red Brome, fig. 8. Material recovered: Spikelets, flowers. Identifying features: Spikelet reddish-purple with five to eight divergent flowers; the awned flowering glume 2-5 cm. long, roughened on the back and curving outwards when mature.

*B. hordeaceus*, L., Soft Brome, fig. 9. Material recovered: Spikelets, flowers. Identifying features: Spikelets five to eight flowered; flowering glumes short and ovoid, about 6 mm. long, bearing an awn about the same length.

*Pappophorum nigricans* (R. Br.), Beauv., Nigger-heads, fig. 10. Material recovered: Fertile flowers. Identifying features: Flowering glume stiff, rounded, bearded at the base with distinct nerves ending in ciliated awn 4-6 mm. long.

*Dactyloctenium radicans* (R. Br.), Beauv., Button-grass, fig. 11. Material recovered: Fragments of inflorescence. Identifying features: Inflorescence of three to five flowered spikelets, compressed, sessile, in two rows along one side of the axis, the end of which projects in a point; spikelets 5 mm. long, outer glumes unequal.

## CHENOPODIACEAE

*Bassia* spp. Material recovered: Perianths enclosing fruits, stems.

*B. patentispis*, And., Spear-fruit Saltbush, fig. 12. Identifying features: Perianth tube slightly hairy, bearing two long divergent spines, and one tubercle; whole ovate to oblong in shape with hollow base.

*B. ventricosa*, J. M. Black, Common name unknown, fig. 13. Identifying features: Perianth tube 2-3 mm. in diameter, and slightly hairy, with four spines; two short and inconspicuous, and two 3-5 mm. long, sharp and pointed.

*B. tricuspis*, F.V.M., Three-spined Saltbush, fig. 14. Identifying features: Perianth tube broad and spreading at the base, bearing three long spines arranged at right angles to each other and parallel to the stem.

\* Flowering glume and palea enclose the grain or flowering parts, the whole known as a "flower." Spikelet consists of one or many flowers enclosed by empty bracts or glumes.

*B. uniflora* (R.Br.), F.V.M., Two-spined Saltbush, fig. 15. Identifying features: Perianth tube almost as broad as long, with circular, hollowed base, covered with short dense hairs and bearing two divergent spines, one with a tubercle at the base.

*Atriplex spongiosum*, F.V.M., Pop Saltbush, fig. 16. Material recovered: Perianths with soft material destroyed. Identifying features: Matrix of perianth, reticulate, hard and dry, with fibrous outgrowths, basket-like in appearance, about 1 cm. long.

*Kochia* spp., Bluebush, fig. 17. Material recovered: Perianths enclosing fruits. Identifying features: Perianth flattened on the top with five horizontal wings attached to rim spreading outwards, also united or singly cleft.

#### COMPOSITAE

*Isoetopsis graminifolia*, Turcz, Grass Cushion, fig. 18. Material recovered: Fruits. Identifying features: Fruit a cylindrical achene, hairy, about 2 mm. long, bearing a pappus of eight to twelve obtuse scales about the same length.

*Calotis cymbacantha*, F.V.M., Yellow Burr-Daisy, fig. 19. Materials recovered: Fruits. Identifying features: Fruit an achene, flat, tuberculate, with two divergent awns, boat shaped at the base and set at right angles to the flat faces of the achene, enclosing the convex apex.

#### BORAGINACEAE

*Lappula concava*, F.V.M., Burr Stickseed, fig. 20. Material recovered: Nutlets. Identifying features: Nutlet with raised margin bearing eight to ten barbed prickles, the back concave and rough (4 nutlets from each fruit).

#### UMBELLIFERAE

*Daucus glochidiatus* (Labill.), Fisch, Mey et Ave-Lall, Australian Carrot, fig. 21. Material recovered: Fruitlets. Identifying features: Fruitlet with three inconspicuous primary ribs and four prominent secondary ribs, the latter bearing long bristles barbed at the tip. (Two fruitlets from each fruit.)

*D. Carota*, L., Wild Carrot, fig. 22. Similar to above, but fruitlet usually smaller and prickles not barbed.

#### ROSACEAE

*Acaena Sanguisorba* (L.F.), Vahl, Bidy-Bidy, fig. 23. Material recovered: Groups of fruits, fruits. Identifying features: Fruits in dense globular heads, about 2 cm. in diameter; each fruit bearing four long prickles barbed at the tip.

#### LEGUMINOSAE

*Trifolium striatum*, L., Knotted Clover, fig. 24. Material recovered: Fruits. Identifying features: Fruit almost globular in shape, covered with fine, soft hairs and bearing five spreading rigid teeth.

*Acacia*, spp., fig. 25. Material recovered: Fragments of leaves, seldom very many present. Identifying features: Typical features of Acacia leaves of phyllode or bi-pinnate types.

#### BRYOPHYTA (Non-Flowering Plants)

*Musci* spp., Mosses, fig. 26. Material recovered: Stems bearing leaves. Identifying features: Features typical of vegetative parts of mosses.

#### MANNER OF RETENTION OF MATERIAL IN THE WOOL.

The fragments of vegetable material discussed above, all possess features which assist their retention in wool. With the fragments of the grasses, the sharp points of the flowering glumes, the rough surfaces of the awns and the glumes and the hairs covering them act in this manner. The other types of vegetable material possess smooth or barbed spines, prickles, or fibrous outgrowths, scaly appendages or fine leafy stems.

Of the species which were not recorded by Milthorpe, two—Pop Saltbush (*Atriplex spongiosum*) and Bidly-Bidly (*Acaena sanguisorba*) were striking. Both were always found in great quantity in the samples from which they were recovered. The perianths of Pop Saltbush from which the soft portions had disappeared, were very hard and impregnated with dirt. They became surrounded by a thick felt of wool, and appeared similar to the burrs produced in wool by fruits of the Medics. The entire heads of Bidly-Bidly were firmly embedded in the wool, or, if the head was broken apart, the individual fruits, when very plentiful, appeared as a brown crust on the surface of the fleece. Any other wool which came in contact with this crust immediately became entangled with it.

### Acknowledgments

I wish to thank the Australian Wool Realisation Commission for permission to publish this paper. To Dr. R. H. Watson, Officer-in-Charge, Australian Wool Realisation Commission Testing House, I am particularly indebted for advice and criticism in compiling the manuscript. I also wish to thank those other members of the staff of the Testing House who have assisted me in the collection of the vegetable matter, together with members of the staff of the Botany School, University of Melbourne, and the National Herbarium, who have assisted me in its identification.

### References

1. BLACK, J. M.: Flora of South Australia. 1924/1943.
2. C.S.I.R.: Standardised Plant Names. Bull. No. 156. 1942.
3. EWART, A. J.: Flora of Victoria. 1930.
4. MILTHORPE, E. J.: Vegetable Matter in the New South Wales Wool Clip, Central Wool Committee Testing House, Sydney, 1943.



FIG. 3. *D. SEMIANNULARIS*  
FLOWERING GLUME



FIG. 4. *D. GENICULATA*  
FLOWERING GLUME

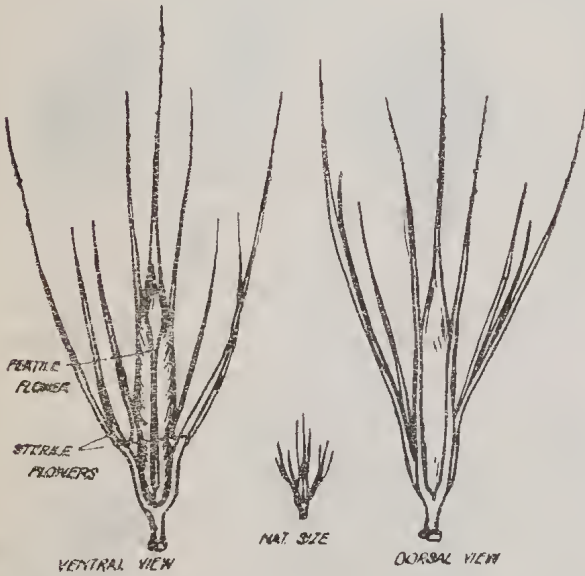


FIG. 5. *H. MARIMUM*  
3-FLOWERED SPIKELET



FIG. 6. *M. STIPOIDES*  
INNER GLUMES





FIG 7. A SCABRUM - SPIKELET & SINGLE FLOWER



FIG 8 B RUBENS - SPIKELET & SINGLE FLOWER

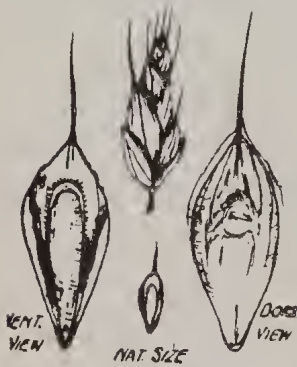


FIG 9 D HORDALEOUS - SPIKELET & SINGLE FLOWER



FIG 10 E NIGRICANS - FLOWERING GLUME

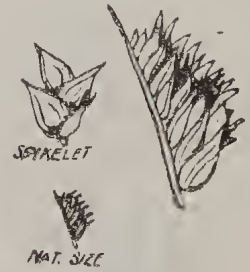


FIG 11. D RADULANS - INFLORESCENCE & SPIKELET



FIG 12 B PATENTICUSPIS - PERIANTH TUBE



FIG 13 B VENTRIQUA - PERIANTH TUBE



FIG 14 B TRICUSPIS - PERIANTH TUBE & STALK





FIG. 15. *E. UNIFLORA* -  
PERIANTH TUBE



FIG. 16. *A. SPONGIOSUM* -  
IMMATURE & MATURE FRUIT

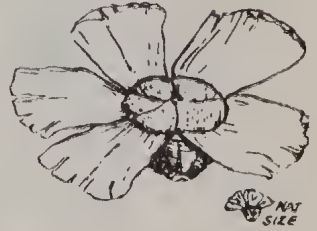


FIG. 17. *KOCHIA* SP. -  
PERIANTH TUBE

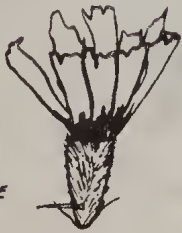


FIG. 18. *I. GRAMINIFOLIA*  
SINGLE ACHENE



FIG. 19. *C. CYMBACANTHA*  
SINGLE ACHENE

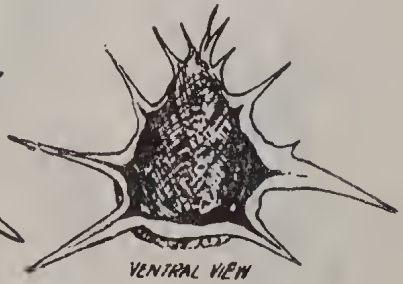
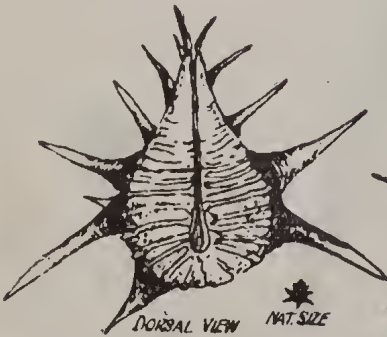


FIG. 20. *L. CONCAVA* SINGLE FRUITLET

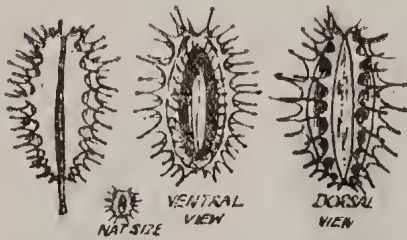


FIG. 21 *D. GLOCHIDIATUS* - PAIRED & SINGLE FRUITLETS

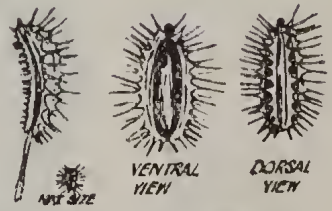


FIG. 22 *D. CAROTA* - PAIRED & SINGLE FRUITLETS

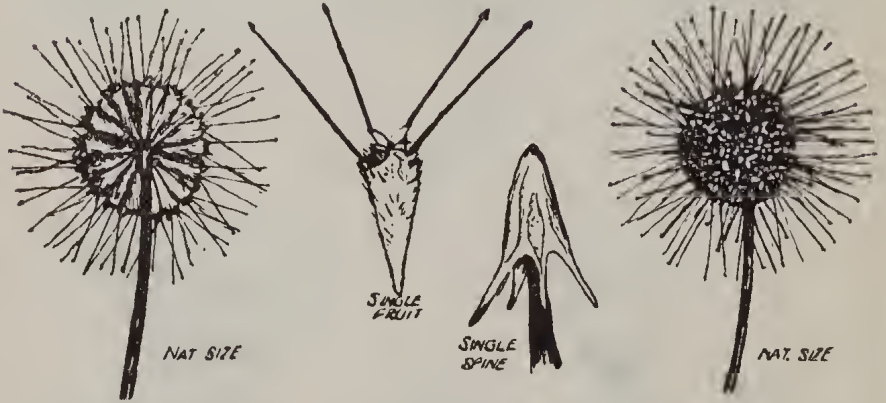


FIG. 23 *A. SANGUISORBA* FRUITING HEAD ENTIRE & IN SECTION

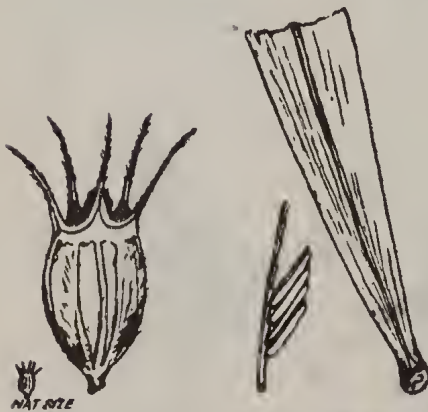


FIG. 24 *T. STRIATUM* - FRUIT

FIG. 25 *ACACIA* SPP. LEAF FRAGMENTS



FIG. 26 *M. MUSCI* SPP. - THREE TYPES